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Volume III: Infrastructures for cities in globalization

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In an oft-quoted piece on the conceptual toolkit used by geographers when addressing 'globalization', Sheppard (2002) proposed the metaphor of 'wormholes' to capture the fact that some physically distant places are tightly connected with one another. Global cities are prototypical examples of such 'wormholes', not in the least in infrastructural terms. The dozens of direct flights and the high-bandwidth telecommunication networks between New York and London, for instance, greatly facilitate all sorts of material and immaterial flows between both cities, thus bringing actors within both cities 'closer' to one another.

Against this backdrop, this volume deals with the 'technical grounding' of cities in globalization, i.e. the infrastructures underlying the day-to-day business carried out in and between global cities. The term 'infrastructure' is hereby used in a general guise, as it involves a wide range of technical arrangements, including container shipping networks, airline networks, and Internet backbone networks. Although each of these and other, related infrastructures are characterized by specific spatial and organizational logics, they have one major function in common: they collectively support the flows of people, ideas, knowledge, capital, goods, etc. that facilitate the (re)production of global cities as strategic places in the world economy.

The straightforward premise underlying this perspective is that global cities are not only prominently connected in infrastructure networks, but above all combine the advantages of assuming central positions in these networks to support the global work that is routinely done within and between these cities. This focus on 'global work' also implies that the research included in this volume does not exclusively focus on the physical insertion of cities in transnational infrastructure networks per se: attention is also paid to how these infrastructure networks are steered, governed and shaped. London, for instance, is obviously not a major seaport, but it is nonetheless one of the most important nodes in today's shipping networks as the world's key maritime and logistics service providers operate from the city (Jacobs et al., 2010 and 2011).

The readings in this volume are organized in six sections. Similar to the other volumes, the first two sections present an overview of (1) antecedents (pioneers who studied cities' involvement in infrastructure networks before globalization

was on the research agenda) and (2) foundation studies (writings from the 1980s and 1990s that set the agendas for subsequent research). The readings in the three following sections feature key studies dealing with a particular type of crucial infrastructure, i.e. (3) ports, (4) airports, and (5) telecommunication networks. The final section of this volume ties some of the insights emanating from these infrastructure-specific analyses together by presenting (6) a series of readings that explicitly contrast and compare cities' involvement in different types of infrastructures.

The antecedents to the literature on infrastructures for cities in globalization are predominantly found in the 'national urban systems' literature, which took a high flight around the time when Walter Christaller's (1933) central-place theory was popularized in Anglo-American academic geography. Although there are in practice only scant conceptual references to Christaller's theory as such, the Christallerean ideas of studying cities as part of a 'city system' in general, and considering the role of transportation therein are key tenets of these writings. The conceptual importance of transportation for the shape and evolution of city networks is explicitly explored in seminal papers by Whebell (1969, p. 1), who coins the term 'corridor' in its guise of a "system of urban places together with the linking surface transport media," while Burghardt (1971, p. 269) introduced the 'gateway city' concept to emphasize the role of transportation in the development of certain cities. In addition to the development of such key concepts, there were also hands-on analyses of urban systems through the lens of infrastructure networks: Taaffe (1962), for instance, investigated the role of airline networks in an assessment of United States cities' fortunes in urban networks, while Bird (1973) explored the role of seaports in the development of city systems.

In most urban research published in the 1960s, 1970s, and well into the 1980s, the study of cities had a strong national focus, to the severe detriment of properly understanding major cities like New York and Chicago (e.g. Taaffe's study deals with the United States proper, thus neglecting major links between US cities and non-US cities). It was only when major cities became interpreted, through a series of influential writings, first as international financial centres (Cohen 1981), then as world cities (Friedmann 1986), and further as global cities (Sassen 1991), that a literature arose in which the study of cities, or some at least, broke free of these national containers. By the end of the 1980s, then, urban scholars had begun to explore the role of infrastructure in the centrality of major cities from a global perspective. In some of the initial work, this global perspective was merely introduced as a 'contextual factor'. For instance, following O'Connor's (1987) lead, Slack's (1989) analysis of how port activities and the provision of port-related services impact port cities' position in the 'urban system' still focuses on a national set of cities (i.e. Canadian cities). However, at the same time, the wider context of the global economy became duly considered, e.g. via the call for an international, comparative perspective. Similar observations can be made with respect to the work by Mitchelson & Wheeler (1994, p. 87), which is reminiscent of much of Castells' (1996, chapter 6) work on the urban geography of the 'Information Society'. Although using national data from Federal Express to infer the level of information exchange amongst US

cities, their purpose is to "reveal how ongoing globalization has affected the position of US cities in the systems of information exchange."
This steady shift towards transnational perspectives on the city/infrastructures nexus is even clearer in a number of other pioneering publications such as those by Warf (1989) and Keeling (1995). Warf's (1989) paper is one of the first in-depth analyses of the ways in which evolutions in telecommunication technologies expedited the globalization of financial services (see also Moss, 1987), which in turn facilitated the globalization of some parts of the economies of major cities. Meanwhile, Keeling (1995) built on the work of Taaffe (1962) and others to explore how and why air transport is a key driver of the globalization of cities, thus being at the forefront of a broad literature on the role of air transport in urban-economic development under conditions of contemporary globalization (e.g. Button and Taylor, 2000; Brueckner, 2003), as well as empirical research that draws on airline data to assess the globalization of cities (e.g. O'Connor, 2003; Otiso et al., 2011).
Building on these foundation studies, from the 1990s onwards, we notice the emergence of literatures that firmly take a global perspective in the study of the city/infrastructures nexus. The analysis of infrastructures for cities and city networks is denationalized in this work, as becomes clear when comparing Taaffe's (1962) paper with that of Smith & Timberlake (2001): both analyses share many formative and analytical features, but US cities are now analyzed as part of a wider, global urban network. The readings in the remaining sections collectively present an overview of some of the main approaches, methodologies, and results that have thus arisen in this research field.

Perhaps the most extensive body of research on the globalized city/infrastructures nexus is the one dealing with airline networks, undoubtedly because air travel and its infrastructures are the most visible manifestation of global connectivity (both in formative and discursive terms). Smith & Timberlake (2001) adopt formal network analysis techniques to probe a dataset detailing the strength of airline connections between major cities across the world between 1977 and 1997, and use these results to infer a broader understanding of how cities are positioned in a global city network (see also Cattan, 1995; Matsumoto 2004; Derudder et al., 2007; Derudder & Witlox, 2008; Neal, 2010). Zook & Brunn (2006) refined this line of research through a more refined methodological framework: they corroborate the patterns revealed by Smith & Timberlake (2001) and others by systematically analyzing the relative time and monetary costs involved in making airline connections to major cities. The final reading in this section by Grubesic and Matisziw (2012) presents a recent update of the connectivity of cities in airline networks, with the further element of discussing some relevant processes that impact the connectivity of cities beyond mere demand (e.g., uneven deregulation and the impact of technological advances, see also O'Connor, 1995; Bowen, 2002 and 2010).

Although the use of telecommunications technologies in studying city networks has a broad record (e.g. the use of telephone networks in Camagni & Salone, 1993), it seems fair to suggest that in the global cities literature the focus has been on the Internet: the infrastructure(s) underlying 'the network of networks' are increasingly seen as being of key importance in the (re)production of cities'

role in the global economy (see Castells, 1996; Townsend, 2001; Malecki, 2002; Graham & Marvin, 2001). The essence of the emerging importance of 'the grids of glass' underlying information exchange between cities are set out in the seminal paper by Graham (1999, p. 929). In line with Castells' writings, he elaborates on the implications of the "(o)pportunities to use new electronic technologies to extend one's social and economic actions across space" as these are "being configured highly unevenly within and between the material geographies of contemporary cities." The evolving geographies of Internet backbone networks have thereupon been invoked to assess how cities are faring in global city networks, and a well-developed example of this line of reasoning can be found in the work of Malecki and Wei (2011). At the same time, however, it can be noted that the complexity of these infrastructure networks necessitates a more refined analytical framework: the reading by Grubesic et al. (2011) presents a state-of the-art overview of how the geographical characteristics of Internet activity centered on key cities can be analyzed.

While the writings on the conceptual and empirical relationships between airline /telecommunications infrastructures and the globalization of cities add up to an entire literature, researchers have only recently rediscovered the relevance of studying maritime networks from a global cities perspective. The reason for this is perhaps that the geographies of maritime networks are – unlike airline and Internet backbone networks – less obviously focused on cities *per se*. That is, although a number of major cities harbor major ports (e.g. Shanghai and Singapore), other cities do not boast obvious links to such networks (e.g. London and Sao Paulo). Hesse (2010, p. 75), however, shows that port cities may well inform the literature on cities in globalization as they provide straightforward examples of how cities are increasingly being defined by their "ability to attract, manage and redirect flows" in myriad networks. This general argument is empirically specified in a paper by Lee & Ducruet (2009), who link the reconfiguration of Singapore and Hong Kong to their function as major port cities (see also Ramos, 2010). Meanwhile, Jacobs et al. (2010) make a very direct link to the global cities literature by devising a typology of cities in terms of their connectivity in the movement of commodities (through seaports) and the exchange of information and knowledge (through the presence of clusters of knowledge-intensive business service firms).

Given the wholesale importance of infrastructures for global cities, there is no reason why analyses should be ghettoized in terms of a certain 'type' of infrastructure: a final strand of research has therefore set out to compare and contrast the network connectivity of cities in different types of infrastructure networks. Choi et al. (2006) compare cities' connectivity in airline and Internet backbone networks, and conclude that these geographies are largely similar, thus underlining the importance of a focus on infrastructure in the study of globalized urbanization. This broad multicollinearity between different types of infrastructural networks focused on major cities is also found in Ducruet et al.'s (2009) comparison of air and maritime transport networks, as they conclude that both make similar contributions to the overall shape of the global urban network (while obviously maintaining their own specificities; for other studies into parallels between different infrastructure networks, see Devriendt et al.,

2010; Liu et al., 2012; Tranos, 2011). And finally, Taylor et al. (2007) correlate air transport flows between major cities and some of the 'business flows' detailed in Volume II of this series (see also Bel & Fageda, 2008): the connectivity of cities in the office networks of globalized producer services firms is compared with their air transport connectivity, after which cities are assessed based on their (comparable) relative position in these networks (for a similar analysis focusing on seaports, see Jacobs et al., 2011). Taken together, this broad support for the remarkable parallels in the geographies of infrastructure networks and the globalization of urban economies underlines the importance of infrastructure in the study of globalized urbanization. Needless to say that the readings presented here cannot do justice to the scope of this literature, but collectively they do give a fair introduction to how infrastructure networks have shaped and are being shaped by cities in globalization.

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